

PARANAUPHOETA RUFIPES BRUNNER IN QUEENSLAND, AND A DESCRIPTION OF
THE FEMALE CALOLAMPRA ELEGANS ROTH AND PRINCIS (DICTYOPTERA :
BLATTARIA : BLABERIDAE).

LOUIS M. ROTH

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Paranauphoeta rufipes Brunner is reported from Cape York Peninsula; it also occurs in New Guinea, Sumatra, Java, and the Moluccas. This species is polymorphic and varies in colour and size. *Paranauphoeta discoidalis* (Walker) is a variant and synonym of *rufipes*. The previously unknown aposematic female of *Calolampira elegans* Roth and Princis is described. □ *Blaberidae*, *Paranauphoeta rufipes*, *Calolampira elegans*, *Queensland*.

Louis M. Roth, Museum of Comparative Zoology, Harvard University, Cambridge MA, 02138, U.S.A.; Correspondence: Box 540, Sherborn, MA, 01770, U.S.A.; 29 July, 1988.

In this paper I give the diagnostic characters for the genus *Paranauphoeta* Brunner and redescribe *Paranauphoeta rufipes* Brunner which has been reported from New Guinea (Irian Jaya and Papua New Guinea), Waigeo, Moluccas, Java, and Sumatra. Additional material, reported here, extends its range to Australia (it was previously reported, identified to genus only, from Shelburne Bay and Iron Range, Queensland, by Kikkawa *et al.*, 1981: 1716, table 3). I also describe the previously unknown female of *Calolampira elegans* Roth and Princis.

Specimens were borrowed through the kindness of the following museums, and their curators: ANIC — Australian National Insect Collection, Canberra, Australia; Dr D.C.F. Rentz. BMNH — British Museum (Natural History), London, England; Mrs J. Marshall. HDEO — Hope Department of Entomology, Oxford, England; Dr G.C. McGavin. MCZH — Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA. NMWA — Naturhistorisches Museum Wien, Vienna, Australia; Dr Ulrike Aspöck. QMBA — Queensland Museum, Brisbane, Australia; Dr G.B. Monteith. RNHL — Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands; Dr J. van Tol. ZILS — Zoological Institute, Lund, Sweden; the late Dr Karlis Princis.

Calolampira elegans Roth and Princis
(Fig. 1A)

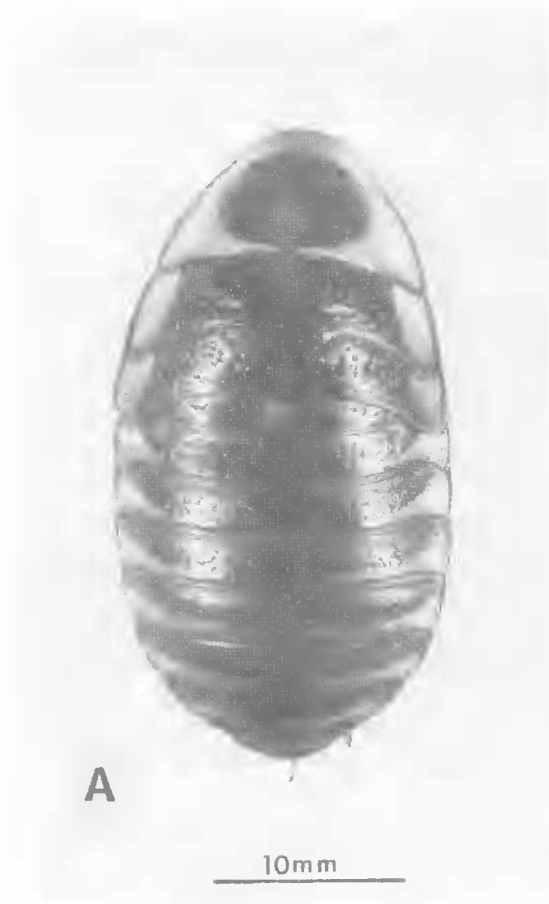
Calolampira elegans Roth and Princis, 1973, p. 103.

MATERIAL EXAMINED

QUEENSLAND. QMBA: 1 ♀, Capella, P.C. Allan, 10.iii.1938 (labelled: Fam. Blaberidae, gen. and sp. nov., M.J. Mackerras, determined; also with an older label 'Cosmozosteria sp.').

DESCRIPTION

FEMALE. Habitus shown in Fig. 1A. Strongly convex. Tegmina and wings absent. Head hidden under pronotum, face flat with few spaced punctations, genae rugulose; eyes wide apart, the interocular space about the same as distance between antennal sockets. Thorax sparsely punctulate; pronotum parabolic. Abdominal terga sparsely punctulate, punctations more distinct on T1–T4, posterolateral angles not produced; supraanal plate transverse, semicircular. Cerci short, not reaching beyond hind margin of supraanal plate. Last abdominal spiracle conical, dorsal at base of cercus. Front leg: anteroventral margin of femur with 3 large spines on basal half, followed by several well spaced minute, piliform spinules, terminating in 1 small heavy spine, posteroventral margin with 0 or 1 spine distad, plus a large terminal spine, genicular spine absent; proximal 4 tarsomeres with pulvilli occupying their entire ventral surfaces, fifth tarsomere with a narrow median line the same colour as the pulvilli, occupying the full length of the segment. Mid leg: anteroventral margin of front femur with 3 large spines plus a distal spine, posterior margin with 1 or 2 spines plus a distal spine, genicular spine present; pulvillus on first tarsomere reaching to about middle of segment, followed by a short double row of small spines, pulvilli on tarsomeres 2–4 occupy their entire ventral surfaces, these without a row of spines. Hind leg: anteroventral margin of femur with 3 large spines plus a distal spine, hind margin unarmed, genicular spine present; pulvilli on first and second tarsomeres apical, preceded by a double row of small spines that extend the full length of the segment, remaining 2 pulvilli as in front and mid tarsi. On all legs, tarsal claws large, simple, symmetrical,



arolia subobsolete (region between bases of claws swollen, but not extended).

Colouration: Head black with a narrow interocular yellow band on top, ocelliform spots small, yellow, lower border of labrum, and clypeus, reddish. Pronotum yellow, margins black, with a large dark macula on disk. Meso- and metanotum black with lateral, yellow, tegmina-shaped markings; hind margin of mesonotum with a pair of indistinct, widely separated reddish spots, larger yellowish spots in a similar position on hind margin of metanotum. Abdominal terga black, yellow, and red, as follows: T1 black; T2 mostly black with lateral yellow borders, the colour tapering to hind margin of segment, a faint indication of red near the lateral anterior margin; amount of red and yellow increases on T3, and more so on the remaining segments so that the black is largely replaced by red, and the yellow runs the full width of the hind margin of T7; basal half of supraanal plate black, followed by yellow, hind border regions sprinkled with black. Abdominal sterna mostly red with hind and lateral borders black, subgenital plate with distal half black. Dorsal surface of cerci yellow, ventrally dark. Legs black, pulvilli yellow; outer edge of front coxae reddish black, those of mid and hind coxae yellow.

Measurements (mm): Length, 34.0; pronotum length \times width, 9.4 \times 14.5.

REMARKS

Calolampra elegans differs from all other species of the genus in lacking tegmina and wings in both sexes. It also is the only *Calolampra* with aposematic colouration, and superficially resembles some coloured species of Polyzosteriinae (hence the old '*Cosmozosteria*' label on the specimen). The unique apterous and aposematically coloured holotype male (from Peak Downs, Queensland, in Stockholm Museum) is smaller than the female (length, 23.0 mm, pronotum length \times width, 7.0 \times 10.0 mm) (Roth and Princis, 1973: 105). Capella and Peak Downs are only 15 km apart in the Central Highlands of Queensland.

FIG. 1. A, *Calolampra elegans* Roth and Princis, female from Capella, Q., habitus. B-D, *Paranauphoeta rufipes* Brunner, males, habitus, and genital phallobes L2d (at apex of L2vm), and R2. B and C locality unknown, D, from Mt Missim (Papua New Guinea).

Paranauphoeta Brunner

Paranauphoeta Brunner, 1865, p. 397; Saussure and Zehntner, 1895, p. 15; Hanitsch, 1915, p. 137. Type-species: *Paranauphoeta circumdata* (Hahn) (= *Blatta/Nauphoeta circumdata* Hahn, 1842, p. 52), selected by Rehn, 1904, p. 558.

DIAGNOSIS

Tegmina and wings fully developed; about basal half of tegmina with punctations between the veins; hind wing and subcosta extending to about middle of wing, costal veins subobsolete or obsolete, costal vein area narrow, coriaceous; median vein simple, cubitus vein with complete and incomplete branches, apical triangle small or absent (Fig. 2J). Anteroventral margin of front femur with a short row of piliform spinules on distal third or less, without long proximal or terminal spines (there may be a single minute stout terminal spine, shorter than a piliform spinule) (Type C), hind margin with only a minute apical spine; front and hind margins of mid and hind femurs without spines or piliform spinules; genicular spine absent from front femur but present on mid and hind femurs; front tibiae with a large dense brush of setae on ventral margin; pulvilli present on 4 proximal tarsomeres of all legs, tarsal claws symmetrical, simple, arolia essentially subobsolete (they do not extend below the bases of the claws, and probably are non-functional). Male: Abdominal terga unspecialized. Subgenital plate weakly asymmetrical bearing widely separated similar, cylindrical styles; in most species the margin of the plate behind the right style is excavated and its posterior corner is sharply produced (Fig. 2D,a). Genitalia with 3 principal phallobes, as in Fig. 2C,D: hooklike phallobere (R2) on right side, robust, with a distinct subapical incision (Fig. 1D); median phallobere (L2vm) rodlike, with a distinctive sclerite (L2d), separated from its apex by a membrane (Fig. 1C).

REMARKS

Princis (1964: 248-251; 1971: 1141) listed 15 species of *Paranauphoeta*, most of them occurring in parts of Asia and Indonesia. The present record of *P. rufipes* extends the known range of the genus to the Australian continent.

The small toothlike projection on the subgenital plate behind the right style is generally characteristic of the genus; it is absent in *Paranauphoeta nigra* Bey-Bienko (Bey-Bienko, 1969, fig. 14; 1970, fig. 14). The subgenital plate of some species of *Perisphaeria* also have a single toothlike projection on the right side (see McKittrick, 1964, pl. 48,

fig. 130E). The subgenital plates of genera of Oxyhaloinae (*Nauphoeta*, *Leucophaea*, *Henschoutedenia*, *Jagrehnia*, *Gromphadorhina*) resemble those of *Paranauphoeta* but they have a spine-like projection behind the right and left styles (see Roth, 1971, figs 2–5).

I have examined the male genitalia of 6 species of *Paranauphoeta* and phallomere L2d (Fig. 1C) is a good distinguishing character in some taxa and possibly could be used for determining relationships between them. The right and left phallomeres are similar in the several species I studied.

Because the pronotal markings of *Paranauphoeta rufipes* are similar to those of *Proscratea complanata* (Perty), Saussure and Zehntner (1895: 16) stated that *Paranauphoeta* is the 'Asiatic counterpart' of *Proscratea* (South America). The similarity between the two genera is superficial. The male genital phallomeres R2 and L2d of *Proscratea complanata* (see Roth, 1973, figs. 46–57) differ markedly from those of *Paranauphoeta* and it belongs in the Pycnoscelinae (Roth, 1973: 256). Princis (1964: 231, 248) placed *Paranauphoeta* in the Perisphaeriinae.

***Paranauphoeta rufipes* Brunner**
(Figs. 1B–D, 2A–I, 3A–L)

Paranauphoeta rufipes Brunner, 1865, p. 400 (♂ ♀); Walker, 1869, p. 122; 1871, p. 5; Saussure, 1872, p. 154; Tepper, 1894, p. 189; Saussure and Zehntner, 1895, p. 16; Brunner, 1898, p. 198; Krauss, 1903, p. 746; Kirby, 1904, p. 180; Karny, 1915, p. 94; Hanitsch, 1923, p. 212; Karny, 1925, p. 190, t. col. fig. 11; Hanitsch, 1931, p. 58, pl. 1, fig. 6 [habitus]; Bruijning, 1947, p. 240; 1948, p. 158; Princis, 1964, p. 251.

Paranauphoeta rufipes var., Saussure, 1872, p. 154.

Paranauphoeta saussurei Karny, 1915, p. 94 (name applied to Saussure's *Paranauphoeta rufipes* var.); Princis, 1958, p. 72 [synonymized with *Paranauphoeta discoidalis* (Walker)].

Paranauphoeta rufipes var. *novae-guineae* Bolívar, 1898, p. 138; Kirby, 1904, p. 180 (synonymized under *Paranauphoeta discoidalis*); Karny, 1915, p. 94, footnote 3 (synonymized with *discoidalis*); Hanitsch, 1923, p. 212 (synonymised with *P. rufipes*); Princis, 1964, p. 251 (stated that Kirby's synonymizing under *discoidalis* was incorrect).

Nauphoeta discoidalis Walker, 1868, p. 39; Tepper, 1893, p. 117.

Paranauphoeta discoidalis (Walker): Kirby, 1904, p. 180; Karny 1915, p. 94; Hanitsch, 1931, p. 58 (synonymized under *P. rufipes*); Princis, 1958, p. 72; 1964, p. 251 (listed *discoidalis* and *rufipes* as distinct taxa).

MATERIAL EXAMINED

LECTOTYPE: Male, Ternate (Moluccas), Mus. Caes. Vind.; in the NMWA, here designated.

PARALECTOTYPES: Ternate. NMWA: 1 ♂ (terminalia slide 51), Deyrolle, col. Br. v. W.; same data as lectotype, 3 ♀.

ADDITIONAL MATERIAL: NEW GUINEA. BMNH: "Dorry", ♀ lectotype (selected by Princis, 1958, p. 72) of *Nauphoeta discoidalis* Walker; 1 ♀ paralectotype of *discoidalis*; "Bubia Lae", 1 ♂, 1 ♀, in native garden, 11.iii.1957, J.H. Ardley. HDEO: "Dor." (probably Dory), 1 ♂ (terminalia slide 226), Wallace; "Bac." (?Batchian), 1 ♀, Wallace; 1 ♀, Wallace. RNHL: 1 ♀.

PAPUA NEW GUINEA. BMNH: East Highland district Watanabe Valley, near Okapa, c. 5000 ft., 1 ♀, 5.ii.1965; Maprik, 1 ♂, 1 ♀, 24.x.1957, J. Smart; Popondetta Dist., Sangara, 1 ♀, 22.iii.1956, E.S. Brown; "Bisi Ptn", N. District of Papua, 1000 ft., 1 ♂, 21–23.?.1964, J.J.H. Szent-Ivany and C. Mayoh; Papua "Mafulu", 4000 ft., 1 ♀, i.1934, L.E. Cheesman; Kokoda, 1200 ft., 1 ♂, viii.1933, L.E. Cheesman. HDEO: Aru, 1 ♂ (terminalia slide 225), Wallace; Astrolabe Geb., British New Guinea, 1 ♂ (terminalia slide 224), presented by Brussels Natural History Museum (labelled var. *novae-guineae* Bol.; determined as *Paranauphoeta rufipes* Brunner by Shelford, 1908; this specimen was mentioned by Hanitsch, 1923, p. 212, and he stated that its colour was pale and washed out). MCZH: Mt. Missim, Morobe District, New Guinea, 1 ♂ (terminalia slide 63), Stevens; Morobe District, 1 ♂, 4 ♀, Stevens.

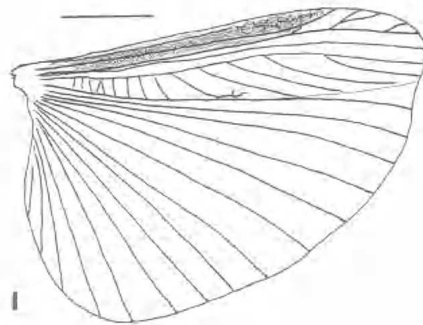
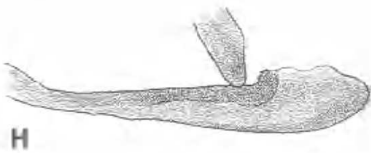
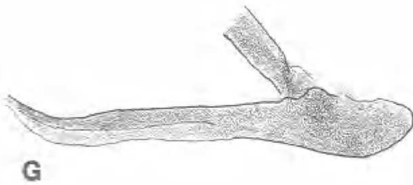
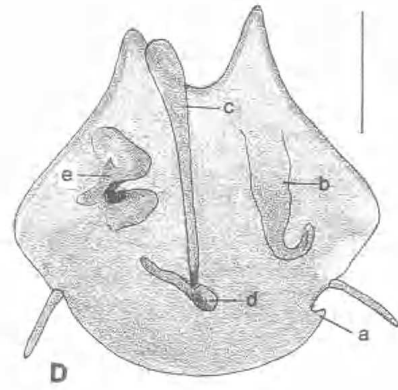
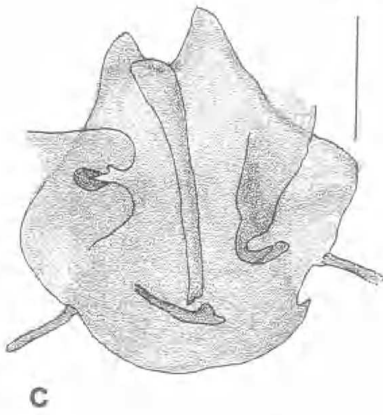
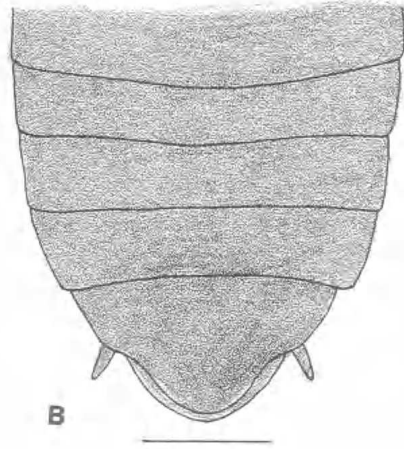
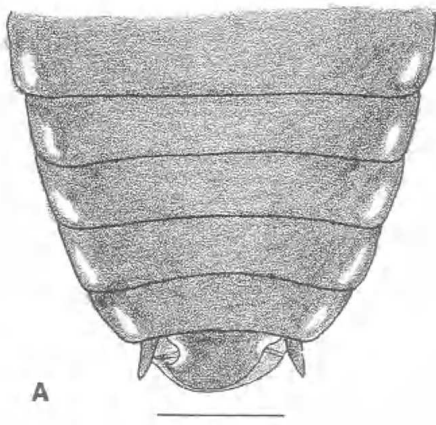
IRIAN JAYA (= NETHERLANDS NEW GUINEA). BMNH: Waigeo (= Waigiou, Waigiou; an island belonging to and off the northwestern coast of Irian Jaya), 1 ♀ paralectotype of *N. discoidalis*. HDEO: "Wag." (= Waigeo), 1 ♀, Wallace E. coll. (1830–73), W.W. Saunders, purchased and presented '73 by Mrs F.W. Hope. RNHL: Fakfak, 1 ♂ (terminalia slide 149), 1 ♀, C.J. Palmer; 1 ♀, Netherlands New Guinea Exped., 1911, Dr P.N. van Kampen; Sekroe, northwest New Guinea, 1 ♀, acquired 1898, K. Schädlér; "Tor Rivier", N. Nw. Guinea, Berkomba, 2 ♀, 17–20.x.1911.

NEW BRITAIN. BMNH: 1 ♀, Reg. Mar. 98, A. Willey.

MOLUCCAS. BMNH: 1 ♂ (terminalia slide 31). MCZH: Halmahera, 1 ♀, T. Barbour (determined by Ashley Gurney, 1948).

JAVA. RNHL: 2 ♀, W.J.E. Hekmeyer.

FIG. 2. *Paranauphoeta rufipes* Brunner. A, male paralectotype from Ternate, abdominal sterna; B, female from New Guinea, abdominal sterna; C, male paralectotype from Ternate, subgenital plate and genitalia (dorsal); D, male from Astrolabe Mt (Papua New Guinea), subgenital plate and genitalia (dorsal: a = toothlike projection on right side of subgenital plate; b = sclerite of the right phallomere R2; c = median sclerite (L2vm); d = dorsal sclerite of left phallomere (L2d); e = L1 sclerite of left phallomere. E–H, male genital phallomeres L2d at apex of L2vm; E, paralectotype from Ternate; F, from Gordon's Mine Area, Iron Range, Q.; G, from New Guinea; H, from Aru (Papua New Guinea). I, female paralectotype, hind wing. Scales (mm); A, B, 3.0; C, D, 1.0; E–H, 0.2; I, 4.0.



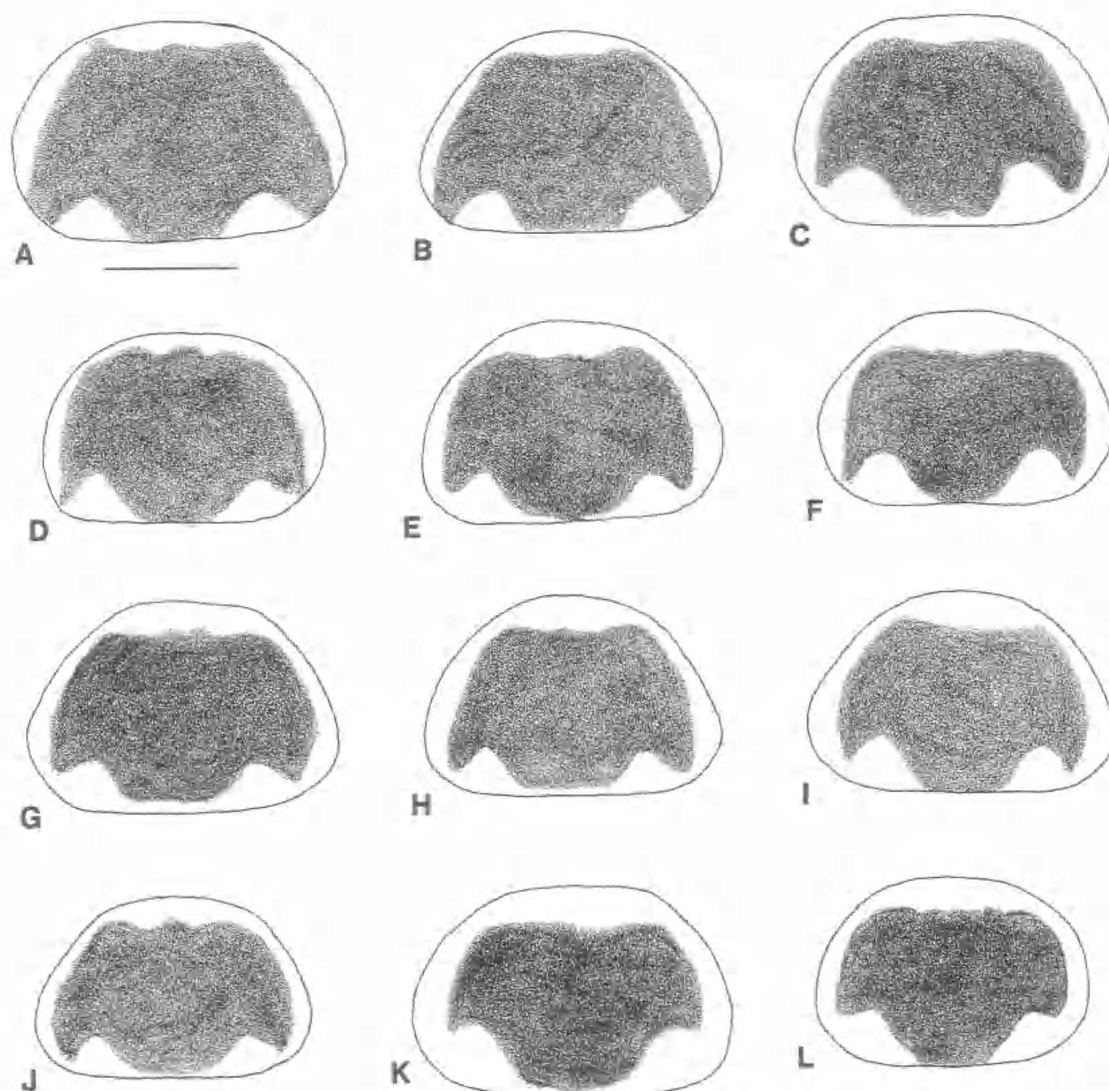


FIG. 3. *Paranauphoeta rufipes* Brunner, pronota: A, female paralectotype from Ternate; B, female from Java; C, female from Halmahera; D, female from Irian Jaya; E, female from New Guinea; F, male from Astrolabe Mt. (Papua New Guinea); G, female from Waigeo, Irian Jaya; H, male from Mt Misim (Papua New Guinea); I, male from Fak, Fak, Irian Jaya; J, female from Sekroe, northwest New Guinea; K, female from 3 km ENE of Mt Tozer, Q.; L, female from 11 km ENE of Mt Tozer. Figs A-C are *rufipes*-like specimens, all others are *discoidalis*-like forms. Scale = 3 mm.

QUEENSLAND. ANIC: The following were collected by D.C.F. Rentz; 3 km ENE of Mt Tozer, nr Iron Range N.P., 12.44S 143.14E, Stop 1-3, 1 ♀, 28.vi.1986; 11 km ENE of Mt Tozer, nr Iron Range, N.P., 12.43S 143.18E, Stop 1-20, 1 ♀ (on tree trunk), 11.vii.1986. QMBA: The following were collected by G.B. Monteith: Dividing Range, 15 km W of Captain Billy Creek, Cape York Pen., 11.40S 142.45E, 1 ♂, 5-12.ii.1976, 1 ♀, 4-9.vii.1975; Gordon's Mine Area, Iron Range, rainforest, 2 ♂ (1 with terminalia slide 71), 1 ♀, 12-18.xii.1976. The following were collected by G.B. Monteith and D. Cook:

Packers Creek, via Portland Road, Pyrethrum knockdown/RF, 1 ♀, 6.xii.1985; West Claudie R., Iron Range, rainforest, 50 m, 1 ♂, 3-10.xii.1985.

No locality data, ZILS: 1 ♂ (terminalia slide 1446), Fried. Wilhelmshafen (labelled *Paranauphoeta saussurei* Karny, by Princis).

DESCRIPTION

MALE. Interocular distance greater than interocellar space. Pronotum with anterior margin rounded, hind margin practically straight, lateral

margins convex, widest behind the middle (Fig. 3). Tegmina and wings fully developed reaching to end of abdomen or slightly beyond. Cubitus vein of hind wing with 1–2 complete and 2–4 incomplete branches, apical triangle essentially absent (Fig. 2I). Abdominal terga unspecialized. Supraanal plate transverse, hind margin convexly rounded, reaching hind margin of subgenital plate. Subgenital plate weakly asymmetrical, styles similar, elongated, slender, cylindrical, widely separated, inter-stylar margin convexly rounded with a small toothlike projection posterior to the right style (Fig. 2D). Anteroventral margin of front femur with a row of piliform spinules (Type C) (there is a minute distal or terminal spine, smaller and heavier than a piliform spinule, which could be considered a subobsolete spine [Type C₁]), arolia subobsolete or absent. Genitalia as in Fig. 2C, D; L2d at apex of L2vm enlarged basally (Fig. 1C, 2E–H).

FEMALE. Supraanal plate broadly rounded. Subgenital plate with margin below cerci concavely excavated, hind margin rounded and fitting closely to the rounded hind margin of the subgenital plate.

Colouration: Head black or dark reddish brown, labrum reddish and yellowish brown, lower half of clypeus and small ocellar spots yellowish. Antennae with basal segments (about 13) shiny, smooth, dark brown or black, remainder hirsute, dull brown. Pronotum with a large brownish black, reddish brown, or black macula which may vary in shape so that the amount of the surrounding pale area (yellow or white) differs; the posterior half of the dark macula is indented with the lateral corners often produced forming a complete or incomplete triangular spot on each side (Figs 3A–L). Left tegmen dark brown, reddish brown, or black with a large yellow, yellowish white, or white macula on basal half of axillary veins, a smaller similarly coloured spot at about the middle, distal region hyaline, veins dark brown; basal half of costa yellow or white, costal veins broadly and irregularly outlined with brownish black or black, the spaces between them yellowish or white, marginal field brownish black or black; that portion of right tegmen covered by the left is hyaline and colourless, the veins in that region mostly dark brown, otherwise with markings similar to the left tegmen. Hind wing not infuscated, costal vein region light or dark brown, veins dark brown. Abdominal terga brown or reddish brown, anterior segments lighter, with broad yellow or whitish yellow lateral borders. Supraanal plate with a dark macula on posterior half, or basally. Abdominal sterna dark

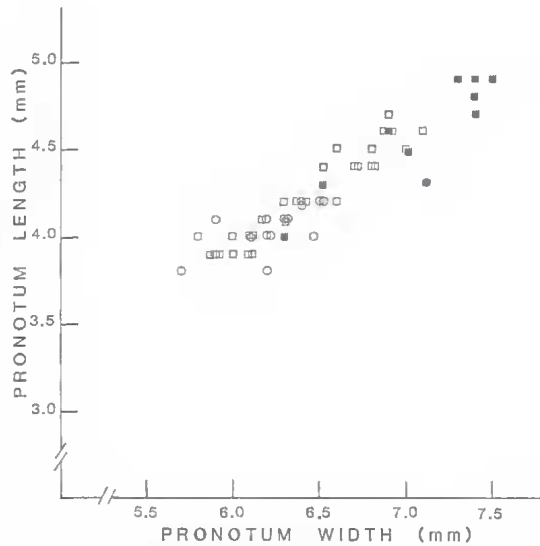


FIG. 4. Pronotal size of *Paranauphoeta rufipes* Brunner. Solid symbols = *rufipes*-like morphs; open symbols = *discoidalis*-like morphs. Circles = males, squares = females.

brown or reddish brown, or black, without markings (Fig. 2B), or with narrow, elongated, yellow, lateral maculae (Fig. 2A). Coxae and femurs dark brown, tibiae and tarsi reddish, or rarely coxae dark brown, femurs, tibiae, and tarsi reddish. Cerci dorsally yellowish or reddish brown with darker basal segments, ventrally dark brown.

Measurements (mm) (♀ in parentheses). Length, 16.8–25.7 (17.7–26.0); pronotum length × width, 3.8–4.8 × 5.7–7.4 (4.0–4.9 × 5.8–7.5); tegmen length, 15.5–20.1 (15.4–21.3). (see Fig. 4).

REMARKS

Karny's (1915: 94) key to species of *Paranauphoeta* was based almost solely on colour of pronotum, tegmina, and legs; among the 17 species in the key were *P. saussurei* (the name he applied to *P. rufipes* var. *Saussurei*), *discoidalis*, and *rufipes*. Although colour markings are useful in distinguishing many species of *Paranauphoeta*, I believe that the above 3 species are one taxon, *rufipes*, which is polymorphic for colour. The light areas usually are yellow with some spots whitish yellow, rarely predominantly white. The lecto- and paralectotypes of *rufipes* and females from 'Bac.', 2 from Java, and 1 from Halmahera have lateral yellow spots on the sterna (Fig. 2A; *rufipes*-like morph); all of the others lack sternal spots (Fig. 2B; *discoidalis*-like morph). One female from near Okapa, Papua New Guinea, has very weak indications of lateral sternal spots. The relatively few specimens available for measurement suggests that

the *rufipes*-like morph might be larger than the *discoidalis* form but their pronotal sizes distinctly overlap (Fig. 4). The male genital phallomere L2d of *discoidalis* is essentially similar to that of *rufipes* when variation in that structure is considered (Figs. 1C, 2E-H).

The Australian morph is *discoidalis*-like but 2 females from 3 and 11 km ENE of Mt Tozer have the dark areas black and the light regions white (pronotum, tegmina, and abdomen); the coxae are black, femurs blackish brown, and tibiae and tarsi reddish. The other morphs from Queensland and elsewhere have the more typical yellowish pale areas, and reddish brown or dark brown dark areas. The genital phallomere L2d of the male from Queensland (Fig. 2F) is similar to the one shown in Fig. 1C.

According to Monteith (pers. comm.), *Paranauphoeta rufipes* '... has a very restricted distribution in Australia, being found only in the rainforests of the central part of Cape York Peninsula. Almost all known specimens come from the Iron Range region, which P.J. Darlington designated the "mid-peninsula" zone in his zoogeographic analysis of the Australian rainforest carabids. It also occurs a little further north at Shelburne Bay (Captain Billy Creek), but interestingly, not at the tip of the Peninsula'.

Brunner's types of *rufipes* came from Ternate (Moluccas). The species has also been recorded from Sumatra and Java (Princis, 1964: 251). Princis gave the localities for *Paranauphoeta discoidalis* Walker as New Guinea and Waigeo, the type localities of the species. He did not list *rufipes* from New Guinea although some of his references listed under this species were those of Hanitsch and Bruijning both of whom considered *discoidalis* a synonym of *rufipes*, and listed the species from Irian Jaya and Papua New Guinea. Princis gave no reason for not accepting this synonymy. Princis (1958: 72) used the presence of the pair of triangular yellow spots in the posterolateral corners of the pronotal macula to distinguish *discoidalis* from *circumdata*, but he did not compare this pattern with *rufipes*. Although Princis claimed that these triangular spots are always present in *discoidalis*, this is not true. In his description of *P. rufipes*, Brunner stated that the form, colour, and outline of the pronotal disk macula were identical to those of *Proscratea complanata* (a South American genus and species). The macula on the pronotum of *complanata* is variable and there may or may not be a pair of pale triangular lateral spots (see Roth, 1973, figs 40-42). The pronotal pattern in *Paranauphoeta rufipes* is similarly variable (Fig.

3). I agree with Hanitsch and others who believed that *discoidalis* is a synonym of *rufipes*.

ACKNOWLEDGEMENTS

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